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ABSTRACT

This technology survey provides an overview of the educational technology options specifically available in the distance education and open learning arena. It examines technological options and their delivery modes in the context of each application. For each option, a definition is provided. Costs are estimated for each application; and advantages, disadvantages, and availability in Australia are sketched. The following technologies are explored: (1) facsimile transmission; (2) computer mediated communication; (3) audio; (4) audiographic; (5) computer assisted instruction; (6) videoconferencing; and (7) television and teleconferencing. The review of available applications makes it apparent that many organizations in Australia have dabbled in the area of educational technology, but few have evaluated the options formally in terms of their appropriateness for course requirements and learner needs. Three appendixes list features of educational technology, applications, and journals and special interest groups dealing with educational technology. (Contains 54 references.) (SLD)

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TECHNOLOGY SURVEY REPORT

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OPEN TRAINING & EDUCATION NETWORK

TAFE

OCCASIONAL PAPERS 2

Technology survey report

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Preface

The Open Training and Education Network (OTEN) of the NSW TAFE Commission came into operation in January 1992. The Network is the major developer of education and training packages, provider of innovative open and distance education delivery to over 20 000 students, and is responsible for the effective implementation of education technologies.

The information in this report was collected as part of the development of OTEN's Technology Strategy. I hope that the report will form the basis of ongoing discussions on the use of educational technology in providing improved access and flexible learning opportunities in TAFE.

Dagmar Schmidmaier
General Manager
Open Training and Education Network

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1. Management Summary

This technology survey provides an overview of the educational technology options specifically available in the distance education and open learning arena.

The report examines technological options, and their delivery modes (such as satellite, ISDN and optical disk) are viewed in the context of each application.

For each option a definition is provided. This is important as a single technology type can have more than one name. The definitions have been based upon those developed by practitioners in the field and in the professional literature. In the case of computer assisted instruction (CAI) and its associated technologies, the terminology used is based on that developed by A. J. Romiszowski, a leading practitioner in this field. However, it should be noted that the terminology and definitions related to educational technology will be modified and/or changed as this and associated technologies develop. This overview also provides a description; covers applications, advantages, disadvantages and costs; and addresses other issues as appropriate.

Costs are per unit and do not include peripheral and associated costs. The costs increase as the number and pieces of hardware and software increase.

Figure 1.1 and Appendix 1 summarise the available technologies and their relationships to each other. Appendix 2 lists each of the technologies and their applications both within Australia and overseas. The list is compiled from information gathered through speaking to users, scanning the literature and relevant directories. Appendix 3 provides a list of Australian and overseas journals and special interest groups in the area of educational technology.

From the results of this report it appears that, in Australia, many organisations have dabbled in the area of educational technology. A number of these organisations have taken up the challenge in earnest and incorporated educational technologies into their delivery of open and distance learning. However, few have undertaken to formally evaluate the technological options in terms of their appropriateness for course requirements and learners' needs.

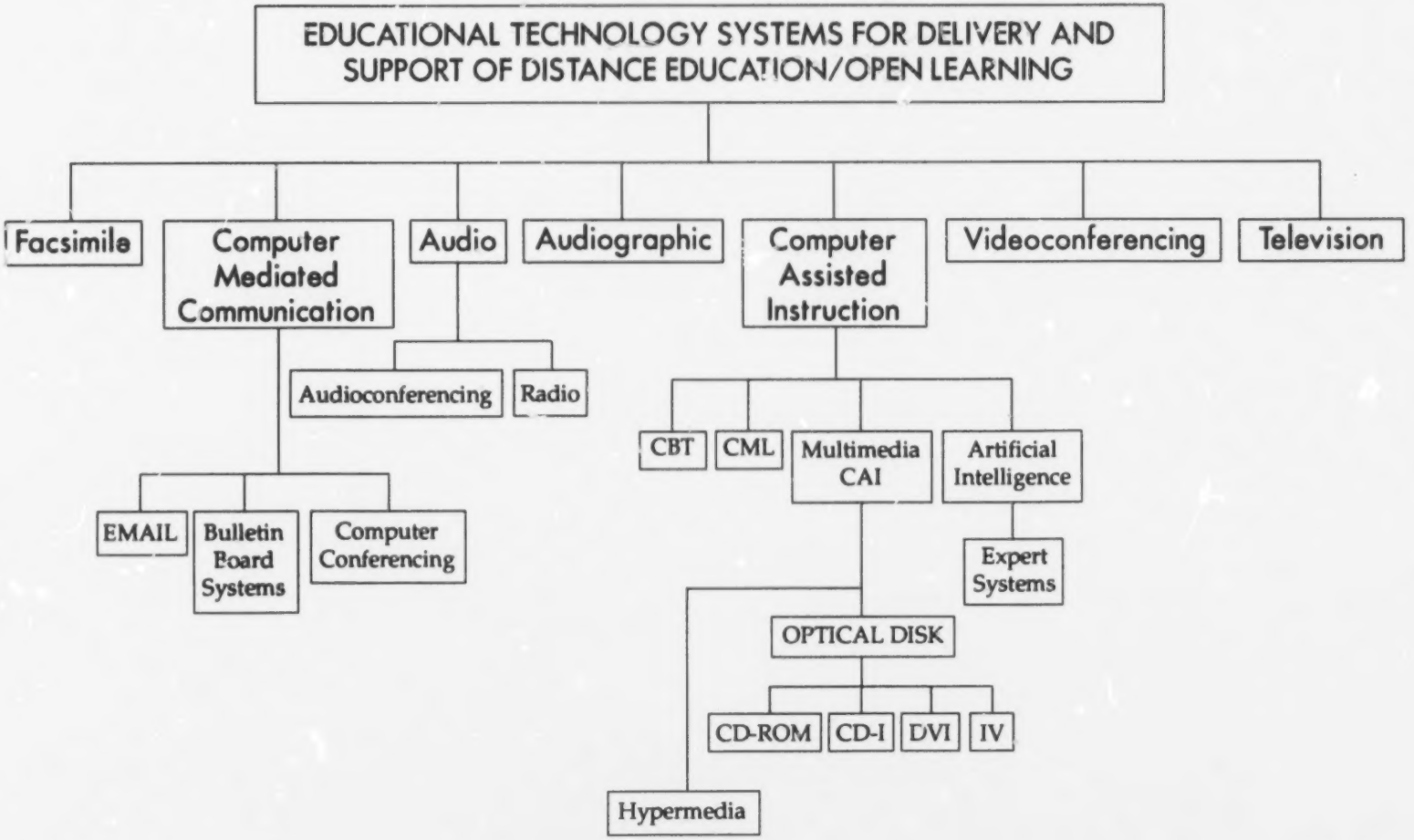
While investigating educational technologies and their applications, the following issues repeatedly appeared as important in the use of educational technology for open learning and distance education:

- No technology can be singled out as intrinsically superior to all others or able to service all needs.*
- Technology cannot be considered in isolation. It must be suited to the learning context, the learner's level of motivation and the level of learning activity.*

- Technology can serve three functions at various stages of learning:
  - to motivate and inform
  - to guide and support
  - to facilitate self-study and independent inquiry.*
- Any implementation of technology requires careful planning and proper evaluation.

* McGregor, A.L., & Latchem, C. R., *Networks for learning: A review of access and equity in post-compulsory education in rural and remote areas of the State of Western Australia*, Perth: Western Australia Office of Higher Education, 1991, p. 49.

FIGURE 1.1 Technological options for distance education and open learning



2. Facsimile

Definition

Facsimile machines allow the transfer of print and graphics, via telephone lines.

Description

- A facsimile machine is a dedicated device containing a scanner for converting printed images into digital form, a modem for sending and receiving data, and a printer.
- The facsimile appears as if a photocopy at the receiving end.
- Facsimile machines and dedicated telephone lines are required at all sending and receiving nodes.
- Printed matter can be sent point-to-point or point-to-multipoint (broadcast fax).

Advantages

- Facsimiles can be an efficient method of sending printed matter to single or multiple sites if normal postal services are slow or inadequate.
- Messages can be received when staff or students are absent.
- International communication is made easier.

Disadvantages

- The quality of print at the receiving end can be poor.
- Graphic reproduction can be poor.
- Facsimile transmission is not recommended for documents requiring high definition (except in some very advanced facsimile systems).
- Pages can be omitted and lost in transmission.

Applications

- For sending and receiving assignments.
- For communication on administration between sites.

Costs

- Hardware:

– basic	$900
– average	$1500–$2000
– advanced	$3000–$5000

- Telecommunications:

– 1 x telephone line (dedicated)	rental charges

- Facsimile messages are charged at the local or STD telephone rates.

Services

- Telecom Australia offers a bureau service for sending facsimile messages called FAXSTREAM.

- Users are able to send faxes via Keylink (Telecom Plus).

3. Computer Mediated Communication (CMC)

Computer mediated communication (CMC) is a general term which covers communication via the electronic screen. Several technologies fall into this category:

- electronic mail
- bulletin board systems
- computer conferencing
- electronic database retrieval.

Computers and telecommunications are used as tools to compose, store, deliver and process the communication.

This technology relies on the basic configuration of a computer with appropriate communications software, cables connected via telephone (modem), and a data network to users with personal computers.

This technology is time and location independent; messages can be received when students or staff are absent.

Electronic Mail (EMAIL)

Definition

Electronic mail (EMAIL) allows messages and other information (including textual and numeric data, computer programs and, in some advanced systems, graphics as well as file transfers) to be transmitted electronically via a computer and telephone line to single or multiple electronic mail boxes, or receiving points, for registered users of an EMAIL network.

Description

- A computer-enhanced memorandum.
- Messages arrive immediately and wait until the receiver is able to read, reply to, delete, print, forward or file the messages.
- Documents can be keyed offline, and then downloaded and sent across an EMAIL network.
- EMAIL is time and location independent.
- Equipment required: personal computer, printer, modem and communications software.

Advantages

- Efficient method of communication across distances.
- A reduction in isolation is achieved.
- Rapid method of communication between individuals and groups.

Disadvantages

- The user is required to regularly check the mailbox for incoming messages.
- Access to necessary hardware is required, and its cost can be high.
- Keyboarding skills are needed.
- EMAIL systems can be complex to use.

Applications

- Provides feedback to students at remote sites.
- Able to send messages and documents.
- Able to transfer computer files.

Costs

- Hardware:

– personal computer	$2000
– printer	$800
– modem	$500
– cable	$20

- Telecommunications:

– 1 x telephone line (dedicated)	rental charges
– telecommunication charges (AUSTPAC)	transmission charges

- Registration fees for mailbox and EMAIL network access (these charges vary between EMAIL networks).
- Software:

– communications software (each PC)	$250
– public domain communications software	$70

Major Australian EMAIL networks

- **AARNet** (Australian Academic Research Network): a private network created by the universities and the CSIRO. AARNet offers a variety of services including EMAIL, worldwide distribution of electronically published news, computer file transfer and gateway services to a wide range of hosts.

- **ILANET** (Information and Libraries Access Network): an electronic messaging network operated through the State Library of NSW. ILANET offers EMAIL access to 400 libraries in Australia and affiliated networks including Pegasus, LANET (UK) and ALANET (US) as well as gateway services to a range of hosts. Other services include facsimile and telex links and library bulletin boards.

- **KEYLINK:** a Telecom Plus service. An electronic mail, fax and telex service.

- **PEGASUS NETWORKS:** a privately operated non-profit organisation. Pegasus Networks offer a variety of services including EMAIL, access to electronically published material, alternative news sources, computer conferences (with particular emphasis on environmental issues), computer file transfer and gateway services to a wide range of hosts.

Charges for access to EMAIL networks (as of January, 1992)

- **AARNet**
  Electronic mail (and news) only affiliate membership:
  - annual subscription $1000
  - telecommunications charges (AUSTPAC) transmission charges
  - Telecom local call charge per log on.

  Full affiliate membership:
  - annual subscription $5000–$30000
  - telecommunications charges (AUSTPAC) transmission charges
  - Telecom local call charge per log on.

- **ILANET**
  - monthly administration fee $20
  - additional mailboxes $5
  - online connect time $0.10 /minute
  - telecommunications charges (AUSTPAC) $0.12 /minute
  - for every 1000 characters sent
    peak $0.07
    off peak $0.04
  - textfile storage $0.70
  - ILAMAIL, software package of preparing messages offline and collection of statistics
  - Telecom local call charge per log on.

- **KEYLINK**
  - establishment fee $530
  - monthly subscription $160
  - cost per log on $0.05
  - online time $0.10 /minute
  - for every 1000 characters sent or received $0.20
  - Desklink (user friendly interface for Keylink) $299
  - Telecom local call charge per log on.

- **PEGASUS NETWORKS**
  - annual subscription $50
  - service fee, for 10 or less log ons per month $18
  - online time charged at
    peak (6 am–8 am) $0.30 /minute
    off peak (8 pm–6 am) $0.15 /minute
  - no telecommunications charges (AUSTPAC)
  - Telecom local call charge per log on.

Services

Some of the other EMAIL services available in Australia are:

- Dialcom (OTC).

Some of the overseas EMAIL networks are:

- Telecom Gold (UK)
- JANET (UK)
- EARN (European Academic and Research Network)
- BINET (US, Because It's Time Network)
- DIALCOM (US)
- EDUNET (US)
- INTERNET (US)
- NSFNET (US, National Science Foundation Network).

Bulletin Boards Systems (BBS)

Definition

Bulletin Board Systems (BBS) are computer-based communication systems that allow users via a personal computer, telephone line and modem, to connect, send and receive messages to the host or other users or transmit data files such as text files or computer programs.

Description

- Electronic BBS can take several forms:
  - electronic mail (EMAIL) for private messages
  - bulletin board messages for special interest groups
  - Q & A services offering technical assistance
  - access to public domain software
  - access to computer games and contests.
- The primary purpose of electronic BBS is to offer an information-sharing service to special interest groups.
- Equipment required: personal computer, printer, modem and communications software.

Advantages

- Efficient method of communication for messages and documents and between individuals in distant locations.
- Helps provide timely information and easy access to sharable written files and computer programs.
- A reduction in isolation is achieved.

Disadvantages

- The user is required to regularly check BBS.
- Access to necessary hardware is required, and its cost can be high.
- Keyboarding skills are needed.

Applications

- Users can access 'invisible' colleagues and experts who collaborate electronically.
- Provides feedback, instruction and tutoring to students at remote sites.

Costs

- Hardware:
  - personal computer $2000
  - printer $800
  - modem $500
  - cable $20
- Telecommunications:
  - 1 x telephone line (dedicated) rental charges
  - telecommunications charges (AUSTPAC) transmission charges

- Software:
  - communications software (each PC) $250
  - public domain communications software $70

Services

Some of the BBS services available in Australia are:

- Brisbane South Regional Bulletin Board (Queensland Department of Education)
- Kimberly Kids BBS (WA)
- ILANET, library bulletin boards
- Nexus, Electronic Information Service (South Australia Department of Education)
- Pegasus Networks.

There are an extensive number of BBS services available worldwide.

Computer Conferencing

Definition

Computer conferencing is a computerised delivery system which facilitates group communication at a time convenient to each participant.

Description

- Asynchronous communication, that is, participants do not have to be at the same place at the same time.
- Participants are all linked by a telecommunication network to a common 'space' for discussion, exchange and communal activity.
- Participants are linked to a mainframe computer through their own PCs, modems and telephone lines. The conferencing software is resident on the mainframe.
- Participants can communicate with a facilitator or with other participants through sending text to the mainframe-based conferencing software. This software organises and keeps track of all communication that occurs since the last log on.
- Computer conferences are organised into items (subjects) so that communications can be organised and are not just isolated messages.
- Communication can be sent publicly or privately.

- Usually conferencing systems provide three functions:
  - read only
  - individual read/write
  - group read/write.
- Discussion will only continue if the 'critical mass' of participants, usually not less than 20, is maintained.
- Time and location independent.
- Equipment required: personal computer, printer, modem and communications software.

Advantages

- Convenient, cost effective interaction between individuals in distant locations.
- Quick feedback to participants is possible.
- Provides network contacts.
- Reduction in isolation is achieved.
- Eliminates travel time and expenses.
- Permits flexible scheduling.
- Provides convenient (potentially 24-hour) access to course materials and to the instructor via electronic mail.
- Provides access to (distant) expert instructors.
- Provides lone learner access to group knowledge and support.
- Enhances opportunities for group interaction.
- Stores communications for convenient access, reflection, and response.
- Provides instruction inexpensively (once initial hardware and software have been acquired).

Disadvantages

- Access to necessary hardware is required.
- Compatibility of hardware can be a problem.
- Institution-centred access to PCs for conferencing has resulted in poor success rate (should be home based).

- Requires use of equipment often unfamiliar to the individual learner.
- Technical difficulties can arise.
- Participants who are used to a passive role may have to be encouraged to become more active participants.
- Lack of face-to-face communication can lead to lengthy and tedious explanations and time-consuming debates. Participants cannot take shortcuts in communication which are possible in face-to-face communication.
- Requires time and effort, both for students and instructors, beyond conventional instruction techniques.
- Requires structure to facilitate learning and to foster interaction.
- Sheer volume of interaction can create information overload and difficulties tracing interchanges.
- Subject to problems including, but not limited to, hardware, software and telephone lines.
- Initial costs of equipment are high.
- Continuing costs exist, such as computer operation and line charges.

Applications

- With distance education programs:
  - optional tutoring method
  - tutorial support for students
  - discussion format for one part of course
  - delivery mechanism of fully online course
  - more effective in course areas which already utilise computers for other reasons.
- Graduate courses based on discussion and exchange.
- Discussion.
- Networking.
- Social interaction.
- Collaborative work projects.
- Maintaining ongoing communication with customers.

Costs

- Hardware:

– personal computer	$2000
– printer	$800
– modem	$500
– cable	$20

- Telecommunications:

– 1 x telephone line	rental charges
– telecommunications charges (AUSTPAC)	transmission charges

- Software:

– communications software (each PC)	$250
– public domain communications software	$70
– computer conferencing software (mainframe)	under licence, to be negotiated from supplier

Services

- Pegasus Networks offers registered users the facilities to set up their own computer conferences.

- Overseas computer conferencing systems include:
  - CoSy conferencing system (Canada, developed by the University of Guelph)
  - CAUCUS (US)
  - CONFER (US, developed by University of Michigan)
  - EIES (US, Electronic Information Exchange System, developed by New Jersey Institute of Technology)
  - PARTI (US).

4. Audio

Audioconferencing

Definition

Audioconferencing is the linking of individuals or groups between two or more locations via telephone lines.

Description

- Telephone lines are linked using an audiobridge.
- Real time interactive, i.e. instantaneous communication.
- Communication can be point-to-point or point-to-multipoint.
- Best used at two or more sites, with small groups of users in distant locations.
- Supplementary material should be sent out in advance (handouts, diagrams, articles).
- Users are connected either by a Telecom system operator with the providing institution paying costs or, where ConferLink audiobridges are used, called up by the chairperson or users can dial in using a special code.
- Equipment required: standard telephone, usually hands free with loadspeaking mode with the addition of omnidirectional microphones for a group of users at a single site.

Advantages

- User friendly in the sense that it is familiar technology.
- No large capital outlay: domestic or workplace telephones can be used.
- No delay between speaking and being heard.
- Savings on time and travel.
- Complements use of other media in distance education.

Disadvantages

- Requires participants attendance at set times.
- Requires some adaptation of behaviour in communicating without visual cues.

- Ineffective for:
  - lecturing
  - constructing complex diagrams
  - conveying lengthy and detailed instructions (however, NSW Department of School Education runs craft sessions using this medium).

Applications

- Meetings.
- Training sessions.
- Tutorials.
- Interviews.
- Obtaining feedback on examinations, assignments and administrative matters.

Costs

- Hardware:
  - telephone with loadspeaking mode
  - audio teleconferencing bridge ConferLink 6 — $8200 (6 lines)
  - omnidirectional microphones
    - ConferLink Multi Voice — $1035 (optional)
    - NEC Voicepoint. — $2650 (optional)
- Telecommunications:
  - 1 x telephone line — rental charges
  - call charges on the day, local or STD rates as applicable
  - ConferLink charges:
    - 2 sites, standard local or STD rates
    - 3 or more sites ConferLink call services rates apply.

Services

- An audioconferencing service available in Australia is Telecom Australia, audioconferencing bureau services which will link up as many sites as required.

Radio

Definition

Radio permits the transmission and detection of communications signals consisting of electromagnetic waves that travel through the air in a straight line or by reflection from the ionsphere or from a communications satellite.

Description

- Real time interactive, i.e. instantaneous communication.
- Information is imparted to carrier wave on AM or FM frequency bands from transmitter to receiver.
- Broadband ISDN can deliver digital hi-fi radio.

Advantages

- Able to reach users over a wide geographic range.

Disadvantages

- A radio licence is needed.
- Access to radio tower is needed.
- Development costs are high.

Applications

- Distance education delivery of lesson materials to remote users.
- Tutorial support.

Costs

The following costs are based on NSW Department of School Education, Distance Education Services:

– capital costs	$35 000 per cell $1500 per outstation with up to $1000 installation costs
– studio setup and equipment	$11 000–$22 000
– leased line links to teaching centre	
(set up)	$2000
(recurrent)	$5000–$8000
– radio licence	as per Department of Transport and communication rates

(School of the Air is exempt from the radio licence charge due to a different provision of the Act and so pay $17/licence for each homestead and base.)

5. Audiographic

Definition

Audiographic technology is the synthesis of audioconferencing and computer-generated graphics, text and still-frame video capability networked by telephone lines.

Description

- Real time interactive, i.e. instantaneous communication.
- Number of sites/network varies but usually two to ten with up to six users per site. Any more sites decreases the interactivity.
- Electronic whiteboard: the teacher can write on the board and speak to students in remote locations by telephone. Students can instantly hear the teacher and see what is written on the whiteboard via a TV monitor or computer screen. Similarly, students can instantly send written and spoken messages to the teacher. With the Optel Telewriter the monitor or VDU becomes the whiteboard.

Advantages

- Relatively simple to learn and to operate.
- Permits not only teacher–student interaction but also allows for student-to-student audio interaction as well as computer graphic interaction.
- Any participating site can serve in either a 'receive' or a 'transmit' mode.
- Students at all sites and the teacher share the same visual reference on the computer screen.
- Operates over normal dial-up telephone lines.
- Technology is moved relatively easily between sites.
- Savings on time and travel are possible.

Disadvantages

- Transmits a still image.
- The instructor cannot see the students, nor can students see the instructor of other students at distance sites.
- Extraneous noise or interference can cause voice transmission on the speaker telephones to 'breakup'.
- Transmission costs using telephone STD can become excessive.

- The video graphics/image displayed between computer monitors is limited to the size of the computer screen unless additional hardware costs are incurred.

- Lesson planning (creation of computer visuals) can be time consuming for the teacher, and floppy disks must be distributed or transmitted downline to all remote sites prior to instruction.

- Interactivity is lost if groups become too large.

Applications

- Conferencing.

- Meetings.

- Training/teaching remote users.

Costs

- Hardware for audiographic technology:

  - video monitor (optional)
  - PC with graphics monitor
  - pen and graphics tablet
  - modem
  - loud speaker telephone.

  One complete system available is the Olivetti Optel Telewriter system. (This includes all the above hardware and authoring software.) — $25 000

  An Optel Telewriter system for receiving and transmitting only — $10 000

  - audio teleconferencing bridge ConferLink 6 — $8 200 (6 lines)
  - omnidirectional microphones:
    - ConferLink Multi Voice — $1 035 (optional)
    - NEC Voicepoint — $2 650 (optional)
  - electronic whiteboard:
    Electronic Classroom, software for MACs [all hardware (MAC, modem, loudspeaker telephone) extra]. 2–3 sites linked easily (for up to 6 sites a MAC II with extra serial ports is required). — $600

- Telecommunications

  - 1 x telephone line — rental charges
  - call charges on the day, local or STD as applicable
  - ConferLink charges
    2 sites, standard local or STD rates apply
    3 or more sites, ConferLink call service rates apply

6. Computer Assisted Instruction (CAI)

Computer assisted instruction (CAI) incorporates a wide range of concepts, techniques, media and technologies. As a result, it is often unclear precisely what is meant by CAI.

For the purpose of this report, CAI is considered to be an interactive learning experience between a learner and a computer in which the computer provides the majority of the stimuli, the learner responds, and the computer analyses the responses and provides feedback to the learner.

The technology is an umbrella term for the following educational technology applications:

- Computer based training (CBT), which includes:
  - computer aided (assisted) education (CAE)
  - computer aided (assisted) learning (CAL)
  - computer based education (CBE)
  - computer based instruction (CBI)
  - computer based learning (CBL).
- Computer managed learning (CML).
- Multimedia CAI, incorporating optical disk and hypermedia.
- Artificial intelligence.

All these technologies are interactive and use computers as their mode of delivery.

Generally, the common advantages of CBT and other forms of interactive multimedia CAI can be said to be:

- Rapid access and immediate accurate feedback making it a powerful and flexible tool for individual and group learning.
- Promotes individual assessment and feedback for users.
- Feedback is timely and supports diagnosis of learning difficulties.
- Attractive visual and auditory presentation.
- Suits a variety of learning styles.
- It is self-pacing.
- Supports mastery learning activities.
- Increases interest and higher retention.
- Increases access in areas of specialist instructor shortages.

- Operates with a range of hardware systems.
- Permits combination of full-motion video, audio and graphics on screen at the same time.
- Full-motion video, audio and graphics appear in real time, as originally captured.
- Provides consistent instruction in a standardised format.

Computer Based Training (CBT)

Definition

Computer based training (CBT) is the interactive use of computers specifically for the delivery of learning/training experiences. It is an individualised instructive medium combining graphics, sound, colour, animation and texts in varying fonts.

Description

- The most common CBT programs consist of generic or custom software on a floppy diskette that runs on a personal computer.
- Mainframe or minicomputers can run CBT lessons for a number of learners simultaneously.
- CBT may involve:
  - prompting students for responses
  - responding to the user input
  - assessing the response
  - controlling and directing the user response.
- CBT is best used when:
  - dynamic visual phenomena are the subject of learning or training
  - information is needed on phenomena which are hard to describe
  - self-testing of student performance in an objective way is needed
  - use of the computer itself is the subject of learning
  - complex/dynamic systems or models are the subject of learning
  - the objective is the structured teaching of some (cognitive) skills.

Advantages

- Interactivity and learner control, including feedback to learner.
- Active learning.
- Able to be used at locations and times suitable to the user.
- Able to incorporate self-assessment and remediation as required.

- Sophisticated multimedia representations of information.
- Permits individualised, self-paced, consistent instruction and delivery at individual workstations.
- Can be used with other media and methods in training and education.

Disadvantages

- High initial development costs.
- Accessible at training centres only; not always available on floppy disk.
- May require administrator or facilitator for student identification, registration, loading of software, other student management and administrative tasks.

Applications

- CBT can be used to teach a variety of knowledge and skills. For example:
  - adult literacy
  - factory processes
  - management and sales techniques
  - proficiency in using various software packages.
- Self-paced learning.
- Competency-based learning.
- Simulation.
- Tutorials.
- Drill and practice.
- Self-testing programs.

Costs

- Authoring software:
  - Tencore $10 000
  - Authorware Professional
    - commercial rate $9990
    - educational rate $1990
- Project team: manager, instructional designer, author, graphic designer.
- One hour of CBT can take 200–500 hours to develop and cost $25 000–$30 000.

Computer Managed Learning (CML)

Definition

Computer managed learning (CML) is the process of using computers to manage the delivery of learning.

It is concerned with managing the progress of students through a course of study by assessing their competence at various stages and advising on the learning action to be taken by the student. It is not concerned with the delivery of educational material which may be achieved through structured workbooks, videos, tutorials, lectures or CAI lessons.

Description

- CML incorporates:
  - curriculum planning
  - scheduling
  - assessment
  - analysis
  - control/tracking function
  - progress monitoring.
- Actual learning may take place via some other form of CAI but may also involve traditional classroom activities, on-the-job training or AV materials.
- Requires learning or training to be competency based.
- Students are 'enrolled' on the computer system in 'courses of study' which comprise a number of 'assessable modules'.
- The computer system advises the student of the next learning activity to be undertaken (usually described in an associated study guide).
- The student may request the computer to issue tests at each stage. These tests may be answered at the computer terminal, but more often they are printed out to be taken away for answering.
- The system normally has the capacity to provide feedback to students on answers given, as a guide to possible remedial activities.
- Students are linked with a supervisor who is given access to the student's progress record and provides tutorial assistance. Most systems incorporate an electronic mail facility to aid communication between supervisors and students.

Advantages

- Ability to maximise the use of scarce resources.
- Rapid identification of learning difficulties.
- Instant and impartial feedback to users.
- Systematic improvement of assessment methods and learning materials through evaluation.
- Ability to cope with an unexpected increases in learner demand for learning programs at relatively short notice and without a major increase in organisational resources.
- Ability to free instructors from tasks which are essentially routine.

Disadvantages

- For networked distribution, availability of good, reliable communications network.
- Lack of user friendliness of larger systems.
- Possible incompatibility of existing hardware held by the organisation with the CML system hardware and software.
- Possible inaccessibility of CML system to the user.
- High implementation costs.
- Isolation between learners.

Applications

- Managing educational instruction/courseware.

Costs

- Appropriate hardware, depending on whether the system is standalone or networked on a mini or microcomputer including peripherals for assessment (printers, graphics tablets, touch sensitive screens, light pens, videodisk, videotape and other instructional media including simulations).
- CML software package.
- Upfront set-up costs at Hamilton College of TAFE using CBTS-CML software networked on the VAX system. Estimated cost per laboratory $500 000+. Laboratories are also operational at Newcastle and Crows Nest.

Services

- Some overseas CML systems include:
  - CAMOL (UK, Computer Assisted Management of Learning)
  - CICERO (UK)
  - Havering CML (UK)
  - Hertfordshire CML (UK)
  - PLATO CML (US)
  - ELMS
  - CBTS-CML

Multimedia CAI

Hypermedia

Definition

Hypermedia is a software program that gives users the power to use, customise and create new information using text, graphics, video, music, voice and animation, with links between related pieces of information. The presentation of this information provides users with the option of navigating through the information in a non-linear sequence.

Description

- Each application is referred to as a 'stack'. Each screen containing information is a 'card', with a stack made up of a series of cards.
- It is possible to navigate through a stack in a lineal sequence or to jump to certain stages within a stack or jump across to other stacks.
- Three elements of a hypermedia system are:
  - individual files ('nodes' or 'fields') which make up the database
  - links ('buttons') that connect the files, serving as references within files and as bridges between files
  - user interface.
- Files that make up the hypermedia database can vary in size from a single document to a large, multivolume, multimedia library. Any file in the database can typically be accessed within a second.

- Hypermedia systems have the following characteristics:
  - nodes, or fragments of information
  - associative links between nodes
  - a network of ideas formed by the link
  - an organisational structure that describes the network
  - the ability to represent explicitly the structure of information in the structure of the hypertext
  - dynamic user control of information
  - a high level of interactivity with user
  - database-like storage structure
  - multimedia information environment
  - multimedia access to information
  - programs available in various formats, floppy disk, CD-ROM or laser disk.

Advantages

- Interactive.
- Self-paced.
- Self-instructional.

Disadvantages

- Users may find it difficult to navigate through information.
- Sometimes little or no guidance is given to user.
- Some level of expertise is required before effective use can be made of the systems.
- Development of effective programs can be expensive; for example, obtaining and incorporating video sequences.

Applications

- No limit on the type of Hypermedia applications in education and training.

Costs

- HyperCard manuals and disks (MAC) (educational rates) $69
- Toolbook (IBM compatible product) manuals and disks $550

Services

- A wide selection of commercially available products use Hypermedia.

Optical Disk

Optical disk is an optical storage device which uses a laser to read the data on the disk. An optical disk has a large storage capacity, holding approximately 650 megabytes of data.

Optical disks include the following technologies:

– CD-ROM	(Compact Disk-Read Only Memory)	Digital
– CD-I	(Compact Disk Interactive)	
– DVI	(Digital Video Interactive)	
– IV	(Interactive Videodisk)	Analog
– WORM	(Write Once Read Many)	
– DRAW	(Direct Read After Write)	

Apart from Interactive Videodisk, WORM and DRAW, the other storage devices use the digital storage of data and, as such, data and visual images can be manipulated and stored on a magnetic medium (floppy disk or hard drive) if necessary.

Compact Disk-Read Only Memory (CD-ROM)

Definition

Compact disk-read only memory (CD-ROM) is a laser storage system in which a range of data types (text, graphics, audio, photographs, still video) can all be stored in digital form and accessed by conventional PCs.

Description

- A mass storage medium for audio, text and visual images in digitally encoded form.
- 4.72 inch CD-ROM disk can store the equivalent of approximately:
  - 500 000 pages of A4 text
  - 20 000 pages of images
  - 550–600 megabytes of storage space.
- Stored information is 'read' by a laser in the CD-ROM player.

Advantages

- Large storage capacity on a single disk.
- Durable.
- Cheap to press disks.
- Permits cross referencing of related information.
- Offers multiple-user pathways with extensive information on each.

- Provides access and navigation methods that include interfaces which permit rapid movement through stored materials and orienting guides that indicate position within the stored information.
- Low-cost delivery of large amounts of static data to multiple sites.
- More economical per byte of data than other high-capability digital storage media.
- Provides an alternative to traditional linear inquiry formats because it allows an inquiry-based approach.

Disadvantages

- Relatively high developmental costs.
- Images use large amounts of storage capacity.
- Slow rate at which images appear on the screen.
- No single standard to store and read information, although High Sierra is becoming the accepted standard.

This means it is not always possible to load and read different CD-ROM disks on a single workstation.

Applications

- Manuals.
- Library catalogues.
- Encyclopaedias.
- Databases.
- References works.
- Records management.

Costs

A product similar to the NSW TAFE Library Services Network CD-ROM Catalog would cost approximately:

- development costs $50 000–$80 000
- recurrent (4 disks/year) $30 000–$40 000 /quarter for 100–150 disks
- purchase of commercially available CD-ROM disks (some costs not one off but recurrent as disks are updated 4–6 times/year and are subscribed to annually). $100–$10 000

Compact Disk Interactive (CD-I) and Digital Video Interactive (DVI)

- CD-I and DVI accomplish a similar task, obtaining full-motion video from an optical storage medium. However, each uses a different approach.
- DVI hardware, developed by Intel Corporation, consists of a chip set to be added to an IBM PC. DVI uses existing hardware configuration of PCs, CD-ROM drives and video displays. Cards containing the chip sets for compression and decompression of digital information are added to the PC to create DVI.
- CD-I hardware, developed by Phillips Corporation, is a separate hardware package based on a Motorola 68000 processor. There is no need to add a separate computer since the CD-I system has a microprocessor built in.
- CD-I and DVI are not compatible as they are built around different processors.

Compact Disk Interactive (CD-I)

Definition

Compact disk interactive (CD-I) is the new generation of compact disk which allows full-motion video and interactivity for the user. CD-I can display and integrate still images, text, audio and moving images.

Description

- CD-I is a complete unit with a microprocessor and CD-ROM drive built in. No additional hardware is required; it is a self-contained device.
- Using CD-I compression techniques, a single compact disk can store:
  - 70 minutes of full-motion video (available at the end of 1992)
  - 72 minutes of high-quality audio
  - 72 hours of speech-quality audio
  - 7000 high-quality photographic images.
- It is possible to navigate through a database in a lineal sequence or jump to related areas of interest within the database.

Advantages

- High degree of interactivity with the user.
- Ability to display and integrate still images, text, audio and moving images.

Disadvantages

- Requires specific hardware to read the disks.
- Incompatibility with PCs.
- High developmental and production costs.

Applications

- Simulation.
- Language learning.
- Audiovisual databases.

Costs

• CD-I player (professional)	$2000–$3000 (March 92)
• CD-I player (consumer) (Both player units must have peripherals such as high definition monitor/TV screen, keyboard, mouse, audio speakers attached.)	$1000 (December 92)
• CD-I disks	not currently available in Australia

Digital Video Interactive (DVI)

Definition

Digital video interactive (DVI) is an optical disk technology that enables the display and integration of full-motion video, high-resolution images, computer graphics, high-quality audio and text.

This technology has the ability to write, erase and rewrite information on the optical disk.

Description

- DVI can integrate the following:
  - 72 minutes of full- motion video and audio
  - 20 minutes of motion video with seven hours of audio and 5000 high-resolution still images.
- Multiple interactivity with mixed video (full or partial screen) and audio, text, and two or three dimensional objects, 360° panoramas.
- DVI workstation comprises 386 PC, DVI board, CD-ROM player and software interface.

- Currently available DVI software only caters for NTSC television transmission systems. Software for PAL systems will be available in Australia in 6–12 months.

Advantages

- Interactive.
- Able to display and integrate still images, text, audio and moving images.
- Integrates with other digital media such as CD-ROM, PCs, WORM, digitalised live video.

Disadvantages

- High developmental and production costs.

Applications

- Simulation.
- Language learning.
- Audiovisual databases.

Costs

• DVI hardware play only device, including all peripherals	$14 500
• Hardware with authoring software	$38 000
• DVI disks	not currently available in Australia

Interactive Videodisk (IV)

Definition

Interactive videodisk (IV) is an instructional system in which text, audio, music, still and full-motion video are stored on a laser optical disk and offers the interactivity of computer-based instruction.

Description

- IV is read by laser and controlled by the PC. This makes it possible to access any point on the videodisk in seconds (maximum search time three seconds).
- Interactivity via touch screen, mouse, light pen or keyboard.
- Contains analog recorded data.

- 8 or 12-inch videodisk can store:
  - 54 000 frames of still images
  - 30 minutes of full-motion video with dual-track audio.

Advantages

- Interactive.
- Self-paced.
- Combines full-motion video, audio and graphics on screen at the same time.
- Video, audio and graphics appear in real time, as originally captured.

Disadvantages

- Some hardware and software incompatibility between systems.
- High developmental costs for hardware, mastering and production of disks, customised courseware.
- High production costs if content requires frequent updating.

Applications

- Tutorials.
- Drill and practice.
- Self-testing programs.
- Technical training applications.
- Hands-on skills training.
- Teaching procedures, operations, equipment maintenance.

Costs

- Using industry standards, the developmental costs are currently estimated to be:
  - per finished minute of video $3000
  - pressing per disk (with this cost decreasing as the number of pressed disks increases) $1000
- IV disks (commerciasIly availbale) $1000–$10 200
- IV player $2450
  - DVA4000 software interface card $3850
  - complete unit, including 386 PC $10 000

Artificial Intelligence (AI)

Definition

Artificial intelligence (AI) is the software technology that allows the computer to mimic human intelligence including those that:

- control movement (robotics)
- understand images (computer vision systems)
- absorb information (learning systems)
- understand and generate speech (voice systems)
- understand human expression and solve problems (expert systems).

These systems have the ability to 'think' in terms of responding to user input and provide information based on user queries or user responses.

Description

- AI systems incorporate pattern recognition and decision theory.
- AI-based training programs are sometimes called intelligent tutoring systems (ITS).

Expert Systems

Definition

An expert system is a computer program or system that applies substantial knowledge of a specific area of expertise to the problem-solving process. Its goal is to make decisions, plan or offer advice comparable to that which would be available from a human expert.

Description

- Expert systems are a broad category of AI software.
- An expert system:
  - tries to solve problems
  - operates in specific area (domain) of knowledge
  - incorporates the level of knowledge that might be expected in that domain.
- Consists of three basic components:
  - subject matter, knowledge-based
  - inference engine—a method for using or applying knowledge
  - user interface—permits interactivity between the system and user.
- Often takes the form of troubleshooting packages that allow the user to input symptoms or examples of the problem in response to prompts.

Advantages

- Opportunity to save money or minimise risk by resolving problem situations faster and more consistently.
- Opportunity to make money by providing improved service or faster, more accurate assessment of a situation.

Disadvantages

- Large amounts of time and money are involved in developing an expert system. It can take two to four years and $50 000–$900 000 to develop a system.
- Some systems make it difficult to redesign a system after evaluative testing.

Applications

- Widely used in medical profession to assist in making diagnoses and identifying courses of treatment.
- Used for problems that typically need an expert to solve them.
- Useful in organisations where decision making is difficult due to lack of knowledge in those attempting to make the decisions.

Costs

Full developmental costs can range between $50 000–$900 000 depending upon the sophistication of system developed.

7. Videoconferencing

Definition

Videoconferencing combines audio and visual media to provide interactive communication between two or more sites (see table 7.1).

Description

- Can be either:
  - one-way video/two-way audio
  - two-way video/two-way audio
  - point-to-point
  - point-to-multipoint.
- Transmission is instantaneous and can display anything that can be captured by a TV/video camera.
- Group sizes can range from two participants point-to-point, to large groups in different multipoint locations.
- Transmission can be via digital or analog links.
- Delivery can be via:
  - ISDN (Microlink, Macrolink, Megalink)
  - optical fibre (broadband ISDN/Telecom FASTPAC)
  - satellite
  - microwave
  - cable.
- Real time interactive, i.e. instantaneous communication.

Three types of videoconferencing systems:

- **Freeze frame/slow scan/captured frame:** uses telephone channel (narrowband) to transmit still-video information. Because of the narrow bandwidth and the resolution of the image, transmission is not immediate: it can take up to 1 minute plus.
- **Compressed video:** video signal is compressed by picture processor or CODEC (COder-DECoder) which reduces channel bandwidth requirements. A moving video image is transmitted via a data channel/ telephone data circuit. Images appear instantly. However, they may be blurred or may not have as high a quality resolution as full-motion images.
- **Full-motion video:** the most expensive technique, full-motion video uses wideband channels to send video, audio and data simultaneously.

Table 7.1 A comparison of videoconferencing modes

Video Conferencing Delivery Mode	Full-motion Video	Number of Sites	Ability to Service Rural & Remote Sites	Degree of Interactivity
ISDN Microlink 64 kb–128 kb bandwidth	No	6–8	Limited*	High
ISDN Macrolink up to 2 mb bandwidth	Yes	6–8	Limited	High
Satellite 2 mb bandwidth	Yes	Unlimited	Yes	Voice only
ISDN Megalink 2 mb+ bandwidth	Yes	6–8	Limited	High
Cable Optical fibre: – broadband ISDN – Telecom FASTPAC 2 mb–100 mb bandwidth	Yes	Unlimited possible	Limited	High

* Microlink currently limited to sites which are < 3.5 km cable distance from the exchange.

Advantages

- Freeze frame: lower costs and flexibility in linking multiples sites.
- Compressed video: the significant reduction in bandwidth needed to transmit a moving image decreases transmission costs.
- Full-motion video: able to send and receive full video, audio and data simultaneously.
- Reduces the feeling of student isolation caused by working alone when using distance or supported self-study methods or on work placements.
- Makes contributions of 'experts' available that otherwise would not be possible due to time and/or distance constraints.
- Allows for continuity of tutor support.
- Facilitates peer group interaction between students on the same course of study but working separately.
- Brings professionals together for updating sessions.
- Makes the running of courses practical by being able to include students not in the immediate catchment area of the providing institution.

Disadvantages

- Freeze frame: inferior resolution and 'jumpy' picture.
- Full motion video: high costs and limitations in linking multiple location because of wide band channel requirements.
- High costs in setting up multiple locations.
- ISDN sites limited because of cabling requirements and complexity of connecting (switching) sites.

Applications

- Meetings.
- Tutorials.
- Training sessions.
- Remote consulting.
- Promotional events.

Costs

- ISDN charges:
  - Microlink (2 channels)
    installation $3000
    rental p.a. $800
  - Macrolink
    installation $3000
    rental p.a. $8000
  - Megalink
    rental p.a. $20 000+
- PictureTel:
  - videoconferencing system unit Model 200 which includes electronics module (CODEC, video switcher, audio mixer, network interface), camera module, keypad and monitors $77 800
- Set up costs per site for compressed video* $120 000
  - microwave to adjacent sites $16 000
  - running costs per site for compressed video $50+ per hour
  - microwave link to adjacent sites minimal, electricity only

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* McGregor, A.L., & Latchem, C. R., *Networks for learning: A review of access and equity in post-compulsory education in rural and remote areas of the State of Western Australia*, Perth: Western Australia Office of Higher Education, 1991.

- Telecom Australia, videoconferencing facilities:
  - hire of Telecom Public Meeting Rooms, costs include studio facilities and transmission charges, 6–8 participants/site, full two-way video/audio
    Sydney–Melbourne $645 per hour
    Sydney–Melbourne–Adelaide $1221 per hour
  - facilities include an international link up.
- UNE Link:
  - hire of rooms and transmission charges
  - rooms are located at Armidale, Coffs Harbour, Lismore and Orange $300–$350 per hour
  - links are available to Telecom Public Meeting Rooms.
- Corrs Australian Solicitors:
  - one charge for room hire and transmission from and to any of their four sites in Sydney, Melbourne, Perth and Adelaide
    point-to-point $500 per hour
    multipoint $1000 per hour
- Lend Lease:
  - costs include room hire and transmission charges

Sydney–Melbourne	$600 per hour
	$300 per 30 mins thereafter
Sydney–Brisbane	$700 per hour
	$350 per 30 mins thereafter
Melbourne–Brisbane	$700 per hour
	$350 per 30 mins thereafter

- Golden West Network (Satellite/WA):
  - one charge for room hire and transmission, point-to-point within Western Australia. $2500

Services

Services in the United States include:

- National University Teleconferencing Network (NUTN), Oklahoma State University:
  - fee-paying, satellite-based consortium of technical institutes, community colleges and universities
  - provides facilities and produces programs aimed primarily at professionals employed in business and industry.
- INTELNET (Indiana's coordinating body for state telecommunications) operates a fibre optic network connecting major population and education centres.

8. Television

Broadcast Television

Definition

A television picture signal (a sequence of electrical impulses) embodies all the picture information to be transmitted from the camera to receiver screen. This is done using amplifiers, cables, transmitting antenna, radio wave in space, receiving antennae and receiver circuits.

It is **one-way** full-motion video to the general public in a defined service area. Transmission can be terrestrial, or by satellite or cable.

Description

- Services, involving satellite or terrestrial distribution, are either:
  - broadcast: signal systems which are designed to cover a given area for open access reception without restriction
  - narrowcast: closed systems with restricted access to specific reception sites.
- Australia uses the 625 line PAL transmission system.
- Transmission using UHF and VHF bands.
- Satellite:
  - B-MAC (B Series-Multiplexed Analogue Components) transmission system used in Australia for satellite transmissions delivered by ABC, SBS, Remote Commercial Television Service (RCTS) and Video and Audio Entertainment and Information Services (VAEIS) television services. Developed for direct-to-home satellite delivery. A decoder associated with satellite receiver would convert the B-MAC signal back to a form suitable for display on existing television receivers.

Advantages

Terrestrial television transmission offers:

- The ability to reach large and remote populations.
- The opportunity to motivate, illustrate and enhance learning.
- Expanded opportunities for education and training.
- Provides explanation, presents evidence.

Satellite transmission offers:

- B-MAC offers performance advantages over existing television systems:
  - reduced colour noise
  - reduced colour/brightness interaction
  - greater number and increased quality of accompanying audio channels.

Disadvantages

- Television courses expensive to produce.
- Terrestrial television transmission offers:
  - limited picture resolution
  - unwanted interaction between colour and brightness signals
  - limited audio quality
  - programming and developmental costs high
  - signal cannot always reach all geographic areas.
- Satellite transmission offers:
  - no single international standard for transmission.

Applications

- Short courses.
- Tutorials.
- Literacy and language programs.
- Vocational training.
- Higher education courses.
- Lectures/seminars.
- Conferences.

Services

Australian television services include:

- Satellite and multipoint distribution services delivering VAEIS; for example, Sky Channel.
- Three RCTS holders:
  - Queensland Satellite Television Network (Q-NET/TSN 11)
  - Golden West Network, WA (GWN)
  - Imparja Television, NT.
- HACBSS (Homestead and Community Broadcasting Satellite Services); for example, ABC and SBS.

Overseas services, particularly US, include:

- Adult Learning Service (ALS) division of the Public Broadcasting Service (PBS):
  - designed to make college credit courses and other formal learning opportunities available to adults
  - incorporates videoconferencing into programming.
- National Narrowcast Service (NNS):
  - parallel service to PBS, designed to deliver video-based education and training directly to the workplace
  - incorporates videoconferencing into programming.
- Instructional Television Fixed Services (ITFS):
  - closed circuit microwave video operating on frequencies designated by the Federal Communications Commission for primarily educational purposes.

The United States has no national educational policy or program. Each state has developed its own educational technology initiatives.

High Definition Television (HDTV)

Definition

High definition television (HDTV) is a new television system which offers improved technical performance. This system provides far clearer and sharper cinema quality pictures on a wider screen.

Description

- Satellite, cable and optical fibre offer wider bandwidth than terrestial transmission systems and, therefore, are the more likely delivery methods for HDTV.
- A new transmission system, MUSE (Japanese), has been developed to transmit signals through satellite transponders (1125 lines, 60 fields/second transmission system).
- MAC series (European) satellite transmission system can also be used to transmit HDTV signal (1250 lines, 50 fields/second transmission system).
- Japanese and European transmission systems, however, are not compatible.
- Studio-quality HDTV requires considerably more bandwidth than existing television systems. Bandwith requirements can be reduced by using signal compression techniques but this may result in a degradation of performance.
- Digital hi-fi sound (multiple channels).

Advantages

- Higher definition pictures.

Disadvantages

- High cost of technology.
- Incompatibility with current frequency planning for terrestrially transmitted television services.
- Introduction of HDTV would require major changes to existing signal delivery methods and necessitate complex consumer decoders.
- No single international standard for production and transmission has been established.

Applications

- Broadband ISDN could deliver multi-channel HDTV. This is a higher capacity service which includes television transmission capabilities.
- Videoconferencing.
- Non-broadcast applications:
  - cinema/movie production
  - education
  - medicine
  - electronic publishing.
- It is unlikely that the necessary environment will exist to support substantial HDTV development, particularly in Australia, in next five to ten years.

Pay TV

Definition

Pay TV is an encoded broadcast television signal for which the user pays.

Description

- Pay TV is part of the federal government reform of the Australian telecommunications industry. It aims to promote liberalisation of the industry and streamline its existing regulatory framework.
- Will be launched in Australia in late 1992/early 1993.

- Can use either:
  - satellite
  - microwave
  - optical fibre as a delivery mode.
- Pay TV took 15–20 years to become viable in the United States.

Applications

- A proposal is currently being considered for an Australian four-channel pay TV network covering movies, news and current affairs, sport and general entertainment.

Costs

- Estimated Australian developmental costs: $500–$700 million.
- User costs: program development costs and studio time and facilities.
- Estimated subscription costs of $40/month.
- No revenue will be available from advertising until July 1997.

9. Appendices

APPENDIX 1: EDUCATIONAL TECHNOLOGY FEATURES MATRIX

FEATURES / TECHNOLOGY	Implementation (hardware costs)	Implementation (software costs)	Recurrent costs	Special skills needed to consume	Access (institution centred)	Access (user centred)	Real time interactive only	Interactive time (student chosen)	Support for learning programs	Stand-alone delivery mode	Audio	Graphic/Text	Visual (still)	Visual (motion)
FACSIMILE	L		L	×	✔	✔	×	✔	✔	×	×	✔	×	×
EMAIL	L	L	L	✔	✔	✔	×	✔	✔	×	×	✔	×	×
BULLETIN BOARD SYSTEM	L	L	L	✔	✔	✔	×	✔	✔	×	×	✔	×	×
COMPUTER CONFERENCING	L	L M	L	✔	✔	✔	×	✔	✔	✔	×	✔	×	×
AUDIO-CONFERENCING	L		L	×	×	✔	✔	×	✔	×	✔			
RADIO	M H		M	×	✔	✔	✔	×	✔	×	✔			
AUDIOGRAPHIC	M	M	L	×	✔	×	✔	×	✔	×	✔	✔	✔	×
COMPUTER BASED TRAINING (CBT) 1 module	M	L	Nil	×	✔	×	×	✔	✔	✔	✔	✔	×	×
COMPUTER MANAGED LEARNING (CML)	H	H	M	×	✔	×	×	✔	✔	×	×	✔	×	×
HYPERMEDIA	L	L	L	✔	✔	×	×	✔	✔	✔	✔	✔	✔	×
CD-ROM (to produce)	H	H	M	✔	✔	×	×	✔	✔	×	✔	✔	✔	×
CD-I (to produce)	H	H	H	✔	✔	×	×	✔	✔	✔	✔	✔	✔	✔
DVI (to produce)	H	H	H	✔	✔	×	×	✔	✔	✔	✔	✔	✔	✔
IV (to produce)	H	H	H	✔	✔	×	×	✔	✔	✔	✔	✔	✔	✔
VIDEO-CONFERENCING	H		L	×	✔	×	✔	×	✔	✔	✔	✔	✔	✔
TELEVISION (BROADCAST/ SATELLITE)	H		H	×	✔	✔	✔	×	✔	✔	✔	✔	✔	✔
HDTV	H		H	×	✔	×	✔	×	✔	✔	✔	✔	✔	✔
PAY TV	H		H	×	✔	✔	✔	×	✔	✔	✔	✔	✔	✔

KEY: Implementation costs (per unit) (hardware/software/recurrent) L = Low <$20 000 M = Medium $20 000–$50 000 H = High >$50 000

☑ YES ☒ NO ☐ NOT APPLICABLE

TECHNOLOGY	AUSTRALIAN APPLICATIONS	OVERSEAS APPLICATIONS
FACSIMILE	• Department of Education (SA): – fax network extends to all 700 government schools. Five machines in the five area education offices. These broadcast to 'hub centres', which then broadcast to between 4 and 20 schools. • Department of School Education (NSW): – fax network.	
COMPUTER MEDIATED COMMUNICATION (CMC) **EMAIL**	• Department of School Education (NSW): – uses Keylink for isolated home pupils, teacher–student and student–student interaction. – Riverina area, electronic blackboard network (MAC/modem/graphics pad) to link students and teachers. • Charles Sturt University (Riverina Campus): – primary means of communication between students and lecturers for Graducate Diploma in Computer Applications. • Deakin University uses EMAIL for course support. • UNINET, consortium of universities in Sydney region (Sydney, Macquarie, UNSW, UTS) linked by optical fibre network. • SA DUCT: four electronic whiteboard sites. • TASNET: links schools in Tasmania.	
BULLETIN BOARD SYSTEM (BBS)	• Department of Education (SA): – Nexus, Electronic Information Service. • Kimberley Kids BBS (WA).	• Michigan State University (USA): – Educational Technology Mailing List BBS.

TECHNOLOGY	AUSTRALIAN APPLICATIONS	OVERSEAS APPLICATIONS
COMPUTER CONFERENCING	• Access to computer conferences is available to registered AARNet and Pegasus Network users.	• University of Guelph (Canada): – uses CoSy to deliver courses. • New Jersey Institute of Technology (USA): – uses EIES to deliver courses. • New York Institute of Technology (USA): – uses CoSy to deliver courses. • British Open University: – uses CoSy to deliver courses.
AUDIO AUDIOCONFERENCING	• NSW: – UNE Link (Armidale, Lismore, Orange, Coffs Harbour) – Charles Sturt University (Mitchell campus) – Department of School Education. • QLD: – Institute of Chartered Accountants – Queensland Open Learning Centres – University of Central Queensland. • VIC: – Deakin University – Department of Education – Bendigo College of TAFE. • SA: – SA DUCT (Diverse Use of Communications Technologies). Developed by SA Department of Education, 250 school locations in SA. – Centre for Applied Learning Systems (CALS, TAFE). • WA: – Western Australia Distance Education Consortium (WADEC).	• University of Madison, Wisconsin Extension Services (USA): – Large scale audioconferenced lectures.

TECHNOLOGY	AUSTRALIAN APPLICATIONS	OVERSEAS APPLICATIONS
RADIO	• NSW: – Department of School Education (Distance Education) uses low band VHF School of the Air Radio Network. • HF radio transmission for state Schools of the Air (NT, Qld, SA, WA).	
AUDIOGRAPHIC	• NSW: – Department of School Education: Leumeah High School, Metropolitan West Region (2-year, 4-school trial). – UNE Link (Lismore campus). • QLD: – University of Southern Queensland – Department of Health. • VIC: – Ministry of Education: rural post-primary schools project, called telematics. – TAFE: Footscray College, Outer Eastern College. • SA: – TAFE: Adelaide College, Regency Park College. – Department of Education uses electronic whiteboards. • WA: – Department of Education Esperance district secondary schools project. • Telecom training centres.	Extensive number of audiographic system users. Users of Olivetti Optel Telewriter system include: • Contact North, tertiary education network (Ontario, Canada) • Knowledge Network (Open Learning Agency) (Canada) • University of Calgary, Faculty of Continuing Education (Canada) • Louisiana State University, Division of Continuing Education (USA) • Pennsylvania teleteaching project, Mansfield University (USA) • Utah State University, COM-NET Services (USA) • Rochester Institute of Technology (USA) • Delaware-Chenango Board of Cooperative Educational Services (USA) • State University of New York (SUNY) College of Technology at Farmingdale (USA) • Boston University School of Medicine (USA).

TECHNOLOGY	AUSTRALIAN APPLICATIONS	OVERSEAS APPLICATIONS
COMPUTER ASSISTED INSTURCTION (CAI) COMPUTER BASED TRAINING (CBT)	• Wide range of commercially available packages. • Packages developed in-house for training within organisations, e.g. OTEN/BHP project. • WA, Central Metropolitan College of TAFE Multimedia Production Unit in Information Technology Centre specialise in development of customised CBT packages. • SA DETAFE develop customised CBT packages.	• Wide range of commerically available packages. • Packages developed in-house for training within organisations, e.g. USA-Prudential Insurance.
COMPUTER MANAGED LEARNING (CML)	• NSW: – Hamilton College of TAFE, Associate Diploma in Business (Microcomputer Systems). – Newcastle TAFE. – Crows Nest TAFE. • QLD: – University of Queensland, Economics degree programs and in Physics Department. • VIC: – Keon Park Technical School – Victoria College in conjunction with Ford Australia and Nissan Australia. • WA: – Curtin University for nursing program. – Telecom, Woodside Offshore Petroleum and Hammersley Iron.	• British Open University uses CICERO CML system. • Southern Alberta Institute of Technology (Canada) uses SAIT CML system.

TECHNOLOGY	AUSTRALIAN APPLICATIONS	OVERSEAS APPLICATIONS
MULTIMEDIA CAI **HYPERMEDIA**	• INFO-ONE International: – Introductory LAWPAC course.	
COMPACT DISK - READ ONLY MEMORY (CD-ROM)	Some of the Australian developed CD-ROMs are: • AUSTROM • SAGE • TAFE Library Services Network Library Catalog. • NRMA motor manuals for service staff. • CLANN cd-cat. • Organisations using this medium to store documents include: – Land Titles Office (VIC) – Mutual Community Insurance (SA). • Footscray Institute of Technology, Technology Based Training Group has developed CD-ROMs in: – Essay Writing – Learning Japanese (Basic Sounds) – Spelling for Technologists – A Talking Dictionary of Medical Terminology (Anatomy) – The Foetal Heart – Phonetics.	A huge range of databases are commercially available on CD-ROM. These include: • bibliographic databases • full-text databases • dictionaries • encyclopaedias • manuals.
COMPACT DISK - INTERACTIVE (CD-I) DIGITAL VIDEO INTERACTIVE (DVI)	• In developmental stage. Some pilot programs underway.	• Limited usage to date. Some commerically available packages.

TECHNOLOGY	AUSTRALIAN APPLICATIONS	OVERSEAS APPLICATIONS
INTERACTIVE VIDEODISK (IV)	• NSW TAFE, Computing ITD: – computing careers and their secrets – interviewing skills for systems analysts – history of Aboriginal people in Australia (prototype). • VIC: – Victoria University of Technology (RMIT campus) Interactive Language Package (ESL) • WA: – Curtin University, two IV disks available. • A selection of general purpose disks available commercially.	• A number of large corporations, businesses, utilities, factory operations, govenment agencies and the military use IV to train a variety of skills. • UK, Domesday interactive video project. • Large number of commercially available products.
ARTIFICIAL INTELLIGENCE EXPERT SYSTEMS	• University of Wollongong: – Developed a system for teaching mathematics.	• A selection of US Expert Systems: – MYCIN (medicine) – PROSPECTOR (geology) – INTEST (Law) – BUILD (architecture) – CHARLIE (automobile mechanics).
VIDEO-CONFERENCING	• Telecom facilities • High Court of Australia – For interlocutory proceedings, particularly leave to appeal. • Federal Department of Defence links Forces Chief (Canberra) with Maritime HQ (Potts Point), Land HQ (Victoria Barracks), Air HQ (Glenbrook) for management meetings and group briefings.	• United States Senate Republican Conference: – allows senators to speak directly with home constituents. • Alaskan Legislative Conferencing Network: – allows representatives to attend legislative sessions or committee sitting electronically.

TECHNOLOGY	AUSTRALIAN APPLICATIONS	OVERSEAS APPLICATIONS
	• Australia Stock Exchange. • Corrs Law firm: – system for Australia-wide practice, including public hire of facilities. • Lend Lease. • NSW: – UNE Link, University of New England (Armidale, Coffs Harbour, Lismore, Orange campuses). • VIC: – Victorian courts for remand hearings and bail applications. – VISTEL Video Conference Network (Victorian State Telecommunications). – Deakin University. – Suraysia Project—16-site network. • QLD: – Palmer Tube Mills conducts board meetings with Chicago-based subsidiary – Family Medicine program, monthly meetings. • SA: – SA DETAFE, 9-site network, TAFE Channel Network. • WA: – Wesfarmers Rural – WA CAE – Curtin University of Technology – WA Fire Brigades.	• JC Penny/US retailer: – for staff meetings. • Central Maine Interactive Telecommunications System. • National Technological University (Fort Collins, Colarado): – five Masters degree to over 200 sites, using academics from 24 universitites in US • California State University at Chico: – upper division and Masters degree courses to student homes. • Apple • Amdahl • Chrysler • Hewlett-Packard • NCR • Sears • Texas Instruments • Wang • Computer Channel, Inc. • Automotive Satellite Television Network.

TECHNOLOGY	AUSTRALIAN APPLICATIONS	OVERSEAS APPLICATIONS
TELEVISION	• AVCC Taskforce has recommended that the university sector either share with a national broadcaster or be granted access to a UHF frequency. • Private Open Learning Channel group lobbying Federal Government to designate SBS or spare satellite transponder as vehicle for an educational TV channel offering degree-related and other educational programming. • ABC: – broadcasting educational television (including nationally via satellite since 1987) – March 1992: broadcasting university level units towards degree programs. • NSW Educational Broadcast Consortium: informal consortium of NSW educational institutions with aim of setting a dedicated educational TV channel on the spare UHF channel. Initially formed to make better use of TV licence held by UNSW. • Community Access Television (CATV) Community group including Metro TV, 2SER, 2RSR. Trial broadcasts July 1990, February 1991. • Open Training and Education Network, Satellite Education Service. • UTS Satellite Education Network. • AUSSAT, Enterprise Channel. • NCR/S-NET (Satellite Network). • Q-NET/TSN11.	• British Open University/BBC. • FDR Tele-Kolleg. • Central Broadcasting and TV University of China. • Canada: – KNOW (British Columbia) – ACCESS (Alberta) – SCAN (Saskatchewan) – TVO (Ontario). • USA networks include: – California State University Systems (satellite) – South Carolina Educational Television Commission (SCETV) – Florida Information Resource Network (FIRN), satellite reception based at community colleges – Indiana Higher Education Telecommunications System (IHETS), microwave-based network – The Learning Channel (Utah) – Star Schools Project, televised video education to schools via satellite.

TECHNOLOGY	AUSTRALIAN APPLICATIONS	OVERSEAS APPLICATIONS
HIGH DEFINITION TELEVISION (HDTV)	• Some production of programs using 1125 line system.	• 1989 52 HDTV programs (Japanese & European) have been made. • NHK (Japan) making HDTV co-productions with: – BBC – Metropolitan Museum (USA) – Bayerischer rundfunk (Germany) – RAI (Italy) – Hughes Communications Telesat (Canada) – Southern Bell.
PAY TV	• Proposal to introduce PAY TV in late 1992/early 1993.	• Service has existed in US, via cable, for 20 years. Service is used primarily for entertainment rather than education.

APPENDIX 3: EDUCATIONAL TECHNOLOGY JOURNALS AND SPECIAL INTEREST GROUPS

Journals

American Journal of Distance Education (US)
Aspects of Educational and Training Technology (UK)
ASPESA News/Papers (Australia)
Australian Journal of Educational Technology (Australia)
British Journal of Educational Technology (UK)
Educational and Training Technology International (UK)
Educational Technology (US)
Educational Technology Research and Development (US)
Electronic Learning (US)
Journal of Distance Education (Canada)
Journal of Educational Techniques and Technologies (US)
Journal of Educational Technology Systems (US)
Media and Methods (US)
Technology and Learning (US)
Techtrends (US)
T.H.E. Journal: Source Guide of High Technology Products for Education (US)

Special Interest Groups

ACET: Australian Council for Education through Technology
AOLIN: Australian Open Learning Information Network
ASCILITE: Australian Society for Computers in Learning in Tertiary Education
ASET: Australian Society of Educational Technology
ASPESA: Australian and South Pacific External Studies Association
HERDSA: Higher Education Research and Development Association (Australia)
NCET: National Council for Educational Technology (UK)
NSPI: National Society for Performance and Instruction (Australia)
Association for Educational and Training Technology (UK)
Association for Educational Communications and Technology (US)
Division of Educational Telecommunications, National University of Continuing Education Association (US)

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